

### **REMARKS**

The Office Action mailed February 1, 2011, has been received and its contents carefully noted. The pending claims, claims 14-20, 22, 23 and 25, were rejected. By this amendment, claims 14-20, 22, 23 and 25 have been canceled, and new claims 26-38 have been added. Support may be found in the specification and the claims as originally filed. No statutory new matter has been added. Therefore, reconsideration and entry of the claims as amended are respectfully requested.

An Information Disclosure Statement is being filed concurrently with this Response.

### **Claim Objections and Rejections**

In the Office Action dated February 1, 2011, the Examiner objected to claim 25 and rejected claims 14-20, 22, 23 and 25.

By this Response, Applicants have canceled claims 14-20, 22, 23 and 25.

Accordingly, Applicants respectfully submit that the Examiner's objection and rejections against claims 14-20, 22, 23 and 25 are moot in view of the amendment to the claims.

### **Application of Wittpahl**

In the previous Office Actions the Examiner cited Wittpahl (US 7,141,270) as a prior art document against the claims of the present application.

Applicants respectfully direct the Examiner's attention to the Petition Decision dated July 25, 2011, whereby a request for entry of an unintentionally delayed claim of benefit has been granted thereby entering a claim of benefit to the Wittpahl patent as a priority document in the present application.

Applicants respectfully request that the Examiner take this claim of benefit to Wittpahl into consideration when examining new claims 26-38.

### **New Claims 26-36**

By this Response, new claims 26-38 have been added. The following discussion is provided to illustrate some of the patentably distinguishing features of new claims 26-38 from the art cited against the previously pending claims.

*New Claim 26*

Applicants' invention as set forth in claim 26 is inclusive of a membrane electrode unit for direct methanol fuel cells (DMFC) having, among others, the following features:

- a) an anode gas diffusion substrate, an ionomer membrane and a cathode gas diffusion substrate;
- b) wherein:
  - i) a cathode catalyst ink is coated on a first side of the ionomer membrane
  - ii) an anode catalyst ink is coated on a second side of the ionomer membrane; and
  - iii) an anode catalyst ink is coated on the anode gas diffusion substrate; and
- c) the anode gas diffusion substrate, is united with the ionomer membrane and the cathode gas diffusion substrate so as to result in:
  - i) a double-layer anode,
  - ii) the double layer anode having a catalyst layer thickness that is larger than a cathode catalyst layer thickness.

Applicants' membrane electrode unit, as set forth in claim 26, provides significant advantageous benefits. As for example, Applicants' membrane electrode unit makes it possible to provide an MEA for direct methanol fuel cells having a higher power density and reduced precious metal loading. See page 4, lines 3-5 of the application as filed.

The double-layer anode can be made with a larger catalyst layer thickness, presenting a high catalyst loading and a high porosity. See page 5, lines 34-37. This double-layer anode allows for an anode catalyst layer that is thicker than the cathode catalyst layer, as for example, by a factor of 2 to 4, and which provides an anode catalyst layer loading that is greater than the cathode catalyst layer loading, as for example, by a factor of 2.5. See page 6, lines 1-7. In addition, due to the smaller layer thickness of the cathode layer, cathode water is transported more rapidly and oxygen diffusion is improved, and, this in turn leads to a considerably improved power density. See page 6, lines 9-19.

Applicants respectfully submit that the documents cited in the previous Office Action, alone or in combination, do not teach or suggests the combination or features (a)-(c) above. In addition, the cited documents do not appreciate and are not capable of achieving the advantages that result from the combination of features (a)-(c) above.

In particular, Tabata, et al. (US 2002/0071980) discloses a membrane electrode assembly (MEA) with the use of double-layer catalyst layers (“2-layer catalyst region”) as an anode catalyst layer or as a cathode catalyst layer. See claim 6. However, Tabata does not indicate that one region is preferred over another (e.g., the cathode side versus the anode side). Rather, Tabata expresses a preference for providing the double-layer structure on both the cathode side and the anode side. See the Examples disclosed in Tabata, all of which are made with the double-layer structure on both the anode and cathode sides. In addition, Tabata discloses the MEA having two double-layer structures being useful for membrane fuel cells in hydrogen/air operations. See ¶¶ [0040], [0072] and [0085]. Also, by way of the two double-layer structures, Tabata describes as a resultant improved stability and durability due to a lower voltage decay rate. See ¶¶ [0017]-[0018].

Tabata says nothing about the comparative thickness of a double-layer catalyst provided on the anode side relative to the thickness of a catalyst layer on the cathode side. Tabata is completely silent in this regard. In addition, Tabata says nothing about the MEA being used in DMFC (direct methanol fuel cells).

Applicants submit that the remaining cited documents do not remedy the above deficiencies of Tabata.

Therefore, Applicants respectfully submit that the claimed invention is novel and unobvious.

#### *New Claim 27*

New claims 28 and 29 include the feature of “the anode catalyst layer has a thickness of between 20 and 200 micron”.

Applicants note that in the Office Action dated February 1, 2011, the Examiner cited Yamashita, et al. (US 5,441,822) as disclosing a catalyst layer within the range of 0.05 to 0.5 mm. See FIG. 5 and col. 5, lines 30-35. The Examiner asserted this portion of Yamashita as corresponding to; and allegedly rendering obvious, the claimed anode catalyst thickness range of “between 20 and 200 microns”.

Applicants submit however that the Examiner’s reliance on this portion of Yamashita is misplaced in this instance. In particular, the Tabata only discloses “the thickness of the catalyst

layer 11 preferably falls within the range of 0.05 to 0.5 mm”. Applicants note that the catalyst layer 11 is the cathode catalyst layer 11, of the cathode electrode 10. See FIG. 3. That is to say, Yamashita says nothing about the thickness of the anode catalyst layer 21.

Therefore, Applicants submit that in addition to the features of claim 26 above, claim 27 is made further novel and unobvious by the features disclosed therein.

#### *New Claims 28 and 29*

New claims 28 and 29 include the feature of “the cathode catalyst layer has a thickness between 5 and 50 microns”.

Applicants note that in the Office Action dated February 1, 2011, the Examiner cited Yamashita, et al. (US 5,441,822) as disclosing a catalyst layer within the range of 0.05 to 0.5 mm. See FIG. 5 and col. 5, lines 30-35. The Examiner asserted this portion of Yamashita as corresponding to; and allegedly rendering obvious, the claimed thickness range of “between 5 and 50 microns”.

Applicants submit, however, that the cited portion of Yamashita does not provide a complete understanding of the disclosed thickness range of Yamashita. In particular, the Examiner’s attention is respectfully directed to col. 5, lines 36-41, where Yamashita states that a catalyst layer thickness of less than 0.05 mm results in a greatly lower cell output.

Accordingly, Applicants submit that Yamashita teaches away from a catalyst layer thickness of less than 0.05 mm and therefore cannot be relied upon to render obvious Applicants’ claimed cathode catalyst layer thickness of “between 5 and 50 microns”.

Therefore, Applicants submit that, in addition to the features of claim 26 above, claims 28 and 29 are made further novel and unobvious by the features disclosed therein.

#### **Request for Interview**

Either a telephonic or an in-person interview is respectfully requested should there be any remaining issues.

### CONCLUSION

All of the stated grounds of objection and rejection have been properly traversed, accommodated, or rendered moot. Therefore, it is respectfully requested that the Examiner reconsider all presently outstanding objections and rejections and that they be withdrawn. It is believed that a full and complete response has been made to the outstanding Official action and, as such, the present application is in condition for allowance. If the Examiner believes, for any reason, that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at the number provided.

It is not believed that extensions of time are required, beyond those that may otherwise be provided for in accompanying documents. However, in the event that additional extensions of time are necessary to prevent abandonment of this application, then such extensions of time are hereby petitioned under 37 C.F.R. §1.136(a). If any additional fees are required, such as fees under 37 C.F.R. §§ 1.16 op 1.17, such fees are requested and hereby authorized to be charged to **Deposit Account No. 024300, Attorney Docket No. 034166.006US.**

Respectfully submitted,



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